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SOME REFLECTIONS ON FORESTRY.

By PROFESSOR SOMERVILLE, F.L.S., F.R.S.E.

FORESTRY may be defined as the cultivation of trees in such a way that the soil shall yield its maximum net financial return. The cultivation of trees may be arranged with an eye to beauty of effect, or for the purpose of providing shelter against gales, or for supplying cover for game. But such tree-planting, though interesting and even useful, is not forestry, for the reason that direct financial return is not its immediate object. It is not many years since the true principles of forestry were recognised in this country, although at an earlier date their significance was fully appreciated in India, and more than a century ago they were strictly applied in the sylvicultural practice of France and Germany. The first impulse towards a more rational system of management of British woodlands may be said to date from the establishment of a Lectureship in Forestry in Edinburgh in 1889. This was followed in 1891 by the creation of a joint Chair of Agriculture and Forestry in the College of Science of Newcastle-on-Tyne, while the visit of a party comprising forty-two members of the Royal Scottish Arboricultural Society to selected forest districts of Germany in 1895 did much to bring home to the minds of practical men the advantages of sound sylvicultural methods. Of late years progress has been comparatively rapid. Teaching by specialists has been provided in the University of Oxford and at the Colleges of Bangor, Cirencester, Edinburgh, and Glasgow; the Office of Woods has established a school in the Forest of Dean, and has placed much of its woodlands under improved management, while many owners of private woodlands have had systematised working plans prepared and have thus provided invaluable object lessons for their neighbours. The action of certain municipalities in planting the catchment areas of their water supplies is deserving of extended imitation. Other agencies, too, have given powerful assistance to the movement, notably the Government through a Departmental Committee of the Board of Agriculture, and the Highland and Agricultural Society of Scotland, the Surveyors' Institution, and the Royal English Arboricultural Society by means of examinations and the granting of diplomas and certificates.

The great guiding principles in rational sylviculture ought to be the curtailment of the expenses of the creation of woodlands and their subsequent management, and the production of timber exhibiting the highest technical properties. A woodland crop necessarily requires a long period in which to attain maturity, and every shilling expended in forming a wood has to bear compound interest during the rotation—perhaps extending to 100 years—and the accumulated sum must be a charge against the final returns. How serious this dead weight on the profits of forestry may be is at once realised by referring to an interest table. For example, if two areas of equal character be stocked with trees, the one at £3 per acre and the other at a cost of £4, it means that to meet the initial expenditure of the extra pound more than £50 must be appropriated from the final returns at the end of a rotation of 100 years, on the basis of 4 per cent. compound interest. How easy it is to pile up expenditure in the creation of a wood those who have had practical experience know only too well. With 4,000 plants to the acre an extra price of 5s. per 1,000 means a dead weight of £1 per acre, and thus at the very start the final net profits may become extremely visionary. And there are many ways in which the initial expenses may be allowed to get abnormally high. A little slackness in the supervision of the labour so that each workman plants only 700 trees when he should be putting in 1,000, or carelessness in the execution of the work so that 20 per cent. or more of the plants die in their first season, necessitating costly "beating up," may make all the difference between profit and loss at the end of the rotation. The toll taken by rabbits, and, to a less extent, by hares, is often very serious, and it is not too much to say that profitable forestry is impossible in the presence of a large head of ground game. No doubt rabbits and hares can be excluded by the use of netting, but this cannot be erected, with the necessary posts and labour, at a cost of less than 3d. per yard, and on a compact block of 10 acres this means an expenditure of £11, or more than £1 per acre. To surround a single acre with netting would, at this rate, cost £3 10s., and an extra initial expenditure of this sum must absolutely preclude any possibility of profit. On the other hand, 100 acres can be protected against ground game at a cost of only about 7s. per acre, and a consideration of these figures emphasises the fact that large areas offer much more chance of profit than small, and moreover they furnish timber of superior technical properties. And not only have rabbits and hares to be considered, but fencing against farm stock has also to be reckoned with, and a fence against sheep and cattle, not to speak of horses, is a much more expensive business than rabbit netting. Those who give their attention to forestry are begin-

ning to realise that there is probably much more fencing in this country than is necessary. One seldom sees woods enclosed by fences on the continent, and at least one owner in this country who plants extensively finds that fences may be largely dispensed with. In any case it would appear that it is the agricultural and pastoral land, not the woodlands, that should be debited with the cost of fencing. The trees will not break out and escape, and it would therefore seem reasonable that the animals for which the fences are designed should be made to bear the cost of their erection.

Other ways in which initial expenses may be kept down will readily occur to practical men. Whenever possible, small plants, say two-year-old seedlings, should be used, and their cost need not exceed five or six shillings a thousand, which compares with £2, more or less, for four-year-old plants. Where poor land, that has once been under the plough, has to be stocked with trees, it is often a simple matter to plough it again at a cost of about 10s. per acre, and if the area is then allowed to lie and mellow for a few months it will be found that quite small and cheap plants may be "dibbled" in at a small outlay, and these, on an area devoid of rough herbage, will generally make rapid growth and soon establish themselves.

Needless to say, much of the success of forestry depends on the proper selection of the right species of trees. In economic forestry the number of species from which to select is a very small one. Amongst conifers the Scots pine is the principal species for poor sands, with the spruce, larch, and Corsican pine for stronger soil. Amongst so-called hard-woods the beech is the most important tree for use on chalky soil, with oak, ash, and elm for better conditions.

Having established a wood with due regard to efficiency combined with economy, the attention of the management is directed towards producing tall straight boles with the minimum amount of branches—which mean knots—and the least possible amount of taper. These objects are gained by keeping the wood as dense as possible until the most vigorous period of height-growth is over—say till about the thirtieth year—and then judicious thinning should begin, partly to secure some return, but chiefly to enable the crowns to expand and so encourage growth in thickness.

The deferred character of the returns from forestry must absolutely prohibit any considerable extension of afforestation on private estates. No doubt we shall have exceptions here and there, where a wealthy landowner makes a hobby of tree-planting, just as another buys pictures, keeps racehorses, or runs an observatory. Sir John Ramsden gave it in evidence before the recent Departmental Committee on Forestry that he had himself placed 12,000 acres of his estates under woods, but private afforestation on such an extensive scale is of rare occurrence. But, speaking generally, the best that can be hoped in the case of private owners is that they will maintain the existing area of their woodlands, and especially that they will subject them to improved management. Of progress in this direction evidence is not lacking, and such examples are sure to encourage imitation. But if afforestation of so-called waste land is to be undertaken on a large scale, it will be State action, not private enterprise, that will effect it, and so far as one can interpret the signs of the times, the dawn of this new era is not imminent.

ESSAY COMPETITION.

THE BEST PLAN FOR THE AFFORESTATION OF THE WASTE LANDS OF THE UNITED KINGDOM.

FIRST PRIZE ESSAY.

By ALEXANDER PHILIP, BRECHIN, N.B.

ALL plans of afforestation involve a somewhat more distant forecast of the future than is called for in most other schemes of public improvement. This, of course, is simply a consequence of the length of time which must elapse before a timber tree reaches maturity. Nevertheless, some such estimate of the future must precede and determine the outlines of any scheme of afforestation.

We find it necessary, therefore, to premise the following propositions, namely:

(1) The commercial demand for timber is likely to be maintained. Notwithstanding the fact that in many important industries the employment of wood has, in recent times, been superseded by iron, steel, or other substitute, notably in ship-building, and now in boat-building, and even to some extent in carriage-building, still the utility of wood is so general and its adaptability so various that we think the above proposition may safely be accepted. New uses for wood are constantly being discovered. A notable instance in recent years is the employment of wood pulp in the manufacture of paper. A recent writer on forestry remarks that each morning's issue of a London daily paper represents the consumption of no less than ten acres of an average forest.

(2) The available supplies of foreign timber are likely to be reduced. On this point all authorities are practically unanimous. Such curtailment of foreign supplies has already been in progress for some time. We might instance the increasing scarcity of Baltic red wood and the similar depletion of the supplies of American yellow pine (Weymouth pine) as important examples of what is taking place. The forests of Northern Europe are already but the shadow of what they were, and the rapid increase of the population of the North American continent cannot fail in the very near future to involve a very serious curtailment there of the surplus timber available for export. Indeed, the people of this country appear not yet to have in any degree realised the gravity of the situation and the probability of an impending timber famine. The recent Departmental Committee of 1902 records the opinion that "the world is rapidly approaching a shortage, if not an actual dearth, in the supply of coniferous timber, which constitutes between 80 and 90 per cent. of the British timber imports."

(3) Home-grown coniferous timber, if well grown and properly matured and scientifically manufactured, can be produced equal in quality for most purposes to the best foreign wood. Of course, there are some foreign woods, such as yellow pine, which could hardly be produced of equal quality in Britain, but in most cases we believe the above proposition to be sound. Certainly the preference for foreign wood in house-building is no mere prejudice. Its greater durability is well established, but what is the reason of this? Partly, perhaps, because the timber is older and heavier; mainly because the mere fact that it has crossed the ocean ensures its being properly seasoned. Where home wood has been employed it has usually been cut hurriedly in summer whilst the trees were full of sap, and immediately made use of. Its durability is, of course, impaired. With proper precautions this need not occur. The writer recalls that nearly twenty years ago, having to renew the roof of a farmsteading situated adjacent to a fine Scots fir wood over seventy years old and quite healthy, he resolved to employ the home wood, but to give it a fair chance. The requisite trees were accordingly cut in winter, when the sap was not running, and carefully stacked up to season for four or five months. The couples are as good to-day as if they had been the best foreign red wood.

Some years ago the writer, having sold a quantity of ripe Scots fir to a wood merchant, who was cutting it up for railway sleepers in the month of July, asked the purchaser whether the sleepers would not have been more durable if the trees had been cut in winter and allowed to

season. The merchant replied that undoubtedly that was so, but he added that the railway company's inspector gave him no better price for wood so treated, and he therefore preferred to cut the timber when the day was long and the weather fine and labour easily procured.

These illustrations are merely intended to support the general proposition above stated, and which we believe to be sanctioned by the best authorities to-day.

Assuming the truth of what we have now premised, our next proposition is that afforestation on a scale to be in any way adequate to the national commercial requirements must be the work of the State. The long postponement of a remunerative return is the principal reason for this. Private proprietors may be relied upon to do all that is necessary for purposes of ornament and shelter, and no one can deny that in many cases they have also done excellently well in the planting of commercial timber. Still, the increasing impatience of long delays in the return on invested money constantly operates against even the continuance to the same extent in the future of such efforts as have been hitherto made by private proprietors. Not only so, but private planting is often conducted under very unfavourable auspices, without properly skilled advice, without a proper or definite plan of operations, and in all cases is liable to interruption in consequence of the different views, and sometimes the necessities, of different owners. The information which has been so generally available in recent years as to the results of scientific State forestry in other countries, and particularly in Germany, has brought home to the minds of most of those interested in afforestation in this country the enormous advantage and greatly-increased profit derivable from a well-planned and consistently-pursued scientific scheme of afforestation.

Such a scheme in Great Britain would necessarily be devoted in the main to the plantation of coniferous trees. Not only do they form the bulk of our commercial timbers, but several of the principal varieties are very favourably adapted to successful growth upon the waste lands of this country; whilst by the rapidity of their growth they allow an earlier return of capital than in the case of hardwood trees. Mr. Stevenson, in his *Trees of Commerce*, remarks, "The proportion between the timber produced by the common pines and the common broad-leaved trees of Europe in a poor, dry soil in any given time is as ten to one."

A plan devoted in the main to planting of coniferous trees would necessarily be applied principally to the hilly, elevated parts of the country. Not only do these comprise the great bulk of our waste lands unsuitable for agriculture, but they are, at the same time, the gathering ground of the gravitation water supplies, which in modern times are an indispensable equipment, not only of large towns, but it may even be said of all populous districts. Sooner or later the scientific survey and conservation of our national water supplies, not only for purposes of sanitation, but also quite possibly in an increasing degree for the production of power, will demand the attention and organised administration of the public authority. We look forward as an ideal to the national administration of the whole mountainous area of the country on scientific lines as the national reservoir for the necessary water supplies and also timber supplies of the whole country, and it must be remembered that the systematic afforestation of these regions would not only augment the water supply and protect it from the consequences of drought, but would also tend to the amelioration of the climate, and would not be inconsistent either with the utilisation of large portions of the area for sheep pasture or with its adaptation to many of the purposes of a national park. The advantage of afforestation of their catchment areas has already been recognised in connection with several of the water schemes promoted by our great cities. In particular we may instance the planting at Vyrnwy and at Talla Water in connection with the Liverpool and Edinburgh systems.

Such a comprehensive national scheme is incapable of immediate attainment. It has been calculated that the waste lands of Great Britain extend to from twelve to fifteen million acres, of which at least one-fifth or one-fourth—probably more—are suited for profitable planting. It would neither be prudent nor financially practicable to attempt a commencement on too large a scale. The success of a number of separate areas of moderate size throughout the country would commend the scheme to public approbation, and the experience gradually gained would obviate the danger that the mistakes and losses, which would to some extent be inevitable in the early stages of such an undertaking, might unfairly discredit it in the eyes of the public.

In the first place, accordingly, we would propose the appointment of a Board of Afforestation with an adequate scientific staff. The first duty of such a board would be to undertake a preliminary survey of the island involving a determination of the areas suitable to be sooner or later included within the scheme of afforestation. The materials already available are very ample, and such a survey need not be expensive. Their next step would be the acquisition of suitable areas in which to commence operations. They would require to be vested with certain compulsory powers to avoid the obstruction which unreasonable opposition might exceptionally occasion, but any general attempt at compulsory expropriation of the land required would be injudicious. It would at once awaken the hostility of proprietors, on whose co-operation the success of any such scheme must largely depend, and it would involve the payment of probably exorbitant compensation, not only to proprietors, but also to sporting and sheep farming tenants, the latter of whom, at any rate, would not, if they had leases of any duration, be at all easily dealt with. In ordinary circumstances we are satisfied that the most favourable tenure for the purpose would be the acquisition of the land under a ninety-nine years' lease. Thus, without interfering with proprietary rights, possession could be got for a period sufficient to enable a crop of coniferous timber to be planted, to reach full maturity, and when ready to be cleared away. There are numerous Highland glens almost entirely treeless and admirably suited for afforestation, and an early effort of the board should be to acquire one or more of these from watershed to watershed at a fair rent. It is likely that the majority of proprietors would in the first instance be slow to negotiate. Doubtless, however, there are not wanting several who would have the sagacity to appreciate the advantage of such a lease. The control of the area would necessarily be in the hands of the board, but their operations, though they might to some extent diminish, need not by any means altogether destroy, its sporting value, and accordingly it might either be arranged that the sporting rights, under proper restrictions, be retained by the proprietor, or, if acquired also under the lease, they would probably afford a source of not inconsiderable revenue from the commencement of the work. The area being determined, the plan of operations would be drawn up. A plan of the rides or unmetalled tracks which would require to be left out for the removal of the ripe timber must be prepared, and where necessary open drains and fences for protection against ground game must be constructed. The planting of such a glen would be distributed over a period of from, say, ten to fifteen years, the object being to provide constant employment for a small staff of workers permanently resident with their families, such districts being altogether unsuited to accommodate large gangs of workmen of the navvy class, the congregation of which is undesirable both on sanitary and other grounds. The gradual prosecution of the work would also involve less interference with grazing and sporting rights and existing leases, in most of which power is reserved for limited resumptions of land for such purposes as planting on fairly reasonable terms. The operations of draining, fencing, surveying, etc., would give employment during the months which were not suitable for planting, and the actual planting would in like manner give employment during the months not suitable for these other operations. By the time that the planting was completed the land first planted would probably be ready for thinning, and in this way continuous employment to a small staff would be given until the first crop of wood was ready to be reaped.

Without employing compulsion, various legal inducements might be held out to landowners to fall in with such a scheme, and after the plan had been judiciously developed to a certain extent and a satisfactory proof afforded to the public of its practical success, it is our belief that many proprietors would not be slow to avail themselves of the attractive prospect of a fixed rent for their waste lands, with Government security at the back of it. It seems unlikely that the abnormally high rents recently paid for grouse moors and deer forests will be maintained for many years longer. In any event, as we have pointed out, many of the sporting amenities of such a district need not be interfered with. A large part of the deer forests of Scotland lie rather above the elevation at which planting would, at least at first, be attempted, whilst the popularity of grouse moors is undoubtedly on the wane, and nothing but a change of fashionable sentiment is necessary for them to be superseded in popular favour by a well-timbered forest amply stocked with roedeer, capercailzie, and other classes of game which thrive in the shelter of

plantations and which after a certain stage of growth would not be injurious.

It must also be remembered that after a few years a large part of the ground would be again available for sheep pasture. In any such extensive plantation there would be numerous open glades, and in some cases the pasture value of the valley as a whole, after the trees attained an age of fifteen or twenty years, would probably be augmented.

The cost of the work of preparation and planting might be estimated at about £5 or £6 per acre. An annual expenditure of, say, £60,000 to commence with would enable some 10,000 acres to be enclosed, drained, and planted annually. Even allowing other £15,000 or £20,000 for the expense of central administration and survey, it is obvious that the annual expense of initiating such a scheme would be quite a trifling item in the national expenditure. On the other hand, it is maintained by various authorities than an average return of 2½ per cent. per annum on the total capital expenditure may be safely relied upon, and that any land that lets at less than 6s. or 7s. per acre may be profitably planted. If that be so, there are a good many million acres in Scotland alone which at their present rents would afford an ample margin of profit. In these calculations we take no account of the probable rise in the price of timber in the not distant future, nor do we take any account of the revenue which might be derived if the area under administration became at all extensive by the sale of cheap annual popular permits for fishing, shooting, or even simply holiday making and camping out, and there are further sources not only of private but of national advantage in the control already referred to of the national water supplies and the judicious impounding of water for the supply of energy. Not only so, but it must further be obvious that for the moderate expenditure mentioned a practical and promising experiment can be made towards the solution of many other pressing social problems.

An expenditure of, say, £5,000,000 spread over a period of years is a mere fleabite compared to the sums voted annually for such purposes as railways in Africa, the stocking of Boer farms, or building of docks at the other end of the world; yet such an expenditure would permit of the afforestation of nearly 1,000,000 acres of our home land and would provide very healthy employment to a considerable number of families. By the time that such an expenditure had been reached returns would begin to come in from thinnings and pit-wood (of which the consumption in Britain at present is enormous), etc. A steady income from timber sales might thereafter be anticipated, in addition to that derivable from grazing rents and other sources already hinted at.

By such time, also, the commercial success and numerous public advantages of such a national project of afforestation would be universally recognised, and should public opinion then find it necessary to enact that any proprietor whose refusal to co-operate voluntarily interfered with the systematic development of the national ideal should be required to accept the State as his tenant at an equitable rent, the cases would probably be but rare in which such compulsion had to be put in operation.

The realisation of such a national scheme is not only commercially practical but urgently demanded. Its outline reveals a vision of our hillsides and uplands embellished by a robe of evergreen woods, sustaining a scattered but in the total a numerous population, offering in the healthy avocations of woodcraft employment to both old and young and enriching the nation by a constantly-growing return.

Amidst such a prospect we seem to see the figure of Hope uprising upon our barren wastes and beckoning, as she alone can do, the labourer back to the land.

Note.—In the areas given in the foregoing paper Ireland is not included, but undoubtedly should not be excluded from the scope of any national scheme.

SECOND PRIZE ESSAY.

By F. H. Osmond-Smith, M.R.A.C., P.A.S.I.

REASONS FOR AFFORESTATION.

THERE are some 26,000,000 acres of waste land in Great Britain, much of which would yield far higher returns than they do at present if they were judiciously and systematically planted. In considering this important question it must be remembered that Europe is living on its capital as regards timber and, in consequence, it is appreciating and must continue to do so in future. The value of timber rose 18 per cent. in Great Britain from 1894-1899; timber imported from Canada rose 15 per cent. during the same period, and in Germany prices have risen 2 to 2½ per cent. during the last fifty years. The annual average amount of timber produced in Great Britain is two million tons, and while three and a third million tons of imported timber were sufficient to meet our requirements in 1864, we have now to import over ten million tons. Germany, France, Belgium, Denmark, Italy, Spain, Holland, Switzerland, Portugal, Bulgaria, and Greece also find it necessary to import timber; whilst Russia, Austria-Hungary, Norway, Sweden, and Roumania are the exporting countries. The respective amount of imports and exports in Europe show that the former exceed the latter by 2,750,000 tons per annum and this deficiency is supplied by Canada and the United States. The three following points should also be duly considered:

1. The *exporting* countries of Europe are *all cutting far more timber than they produce* with the exception of Russia.

2. The Canadian woods have been cut so hard that it now pays better to cut second class timber near the coast than to proceed further inland and obtain the best.

3. Mr. Nisbet, one of our leading authorities, writing in 1894, states: "In fifty years the American forests will be exhausted *even if the rate of timber exhaustion does not exceed its present dimensions.*

These facts show that future supplies must be drawn chiefly from Russia and Canada, and that the increasing demand and reduced supplies must result in woods producing a far higher revenue than they have done in the past.

THE ECONOMICAL AFFORESTATION OF WASTE LANDS.

Of the 26,000,000 acres of waste land probably not more than one-third to one-quarter is suitable for economical afforestation and the amount which is available can only be ascertained by an inquiry conducted by men who have a thorough practical knowledge of the subject. Rights of Common exist over vast areas, and it is impossible to utilise these lands for afforestation under existing conditions. On other portions the cost of draining and rendering the land suitable for planting would be too prohibitive to obtain financial success, whilst in some places the excessive height of the land above sea level retards the growth of trees to such an extent as to render it useless for this purpose, and, in addition, the position of some land prevents timber being grown on it at a profit owing to the excessive cost that would be incurred in removing the trees when mature. A certain portion of waste land is also used for sheep runs, and is let with farms, the rental value of which would be decreased considerably if these lands were taken from it.

Land which will grow Scotch or spruce, if it is a considerable distance from a consuming centre, cannot usually be planted to yield a profitable return. The average value of these trees is 6d. and 4d. a foot respectively and as the cost of haulage is 1d. per foot for the first mile and ½d. for each successive one, they are only worth the cost of cutting to the timber merchant and of no direct value to the landowner in such a case. If the same area had been suitable for the growth of ash or larch, which are worth 1s. to 2s. and 10d. to 1s. 2d. a foot respectively, this land would yield a good return if planted.

Subject to these conditions, it is indisputable that all other lands which are worth less than 5s. per acre per annum and are capable of supporting the growth of trees would yield far higher returns when planted than they do at present, the returns varying according to the value of the tree which the land is capable of growing and the time it takes to mature, larch and ash being most profitable. The planting of waste land should be undertaken, not only by landowners, but also by Municipal Bodies, by planting up catchment areas, and also by the Government. In order to encourage landowners to plant, woods should be relieved of taxation until they begin to produce revenue. A far larger area of land would be rendered available for afforestation by buying out the rights of the Commoners on land suitable for planting and removing the restrictions placed on it by the Enclosures Acts where it is required for this purpose. In the New Forest and in the Forest

of Dean the rights of common which exist there have been, and are still, detrimental to the production of the greatest possible profit.

STATE FORESTRY.

Germany, France, and Belgium have organised departments to deal with this subject and it is surprising that the British Government have not followed their example, but there is no doubt that circumstances will compel them to do so in the near future. It is continually stated that a continental system of forestry cannot be adopted in Great Britain. This is true to a certain extent on estates where change of ownership prevents continuity of policy and where the preservation of game is a matter of considerable importance; but neither of these objections holds good in State forestry where continuity of policy is assured and game is not preserved. The soil and climate of Great Britain is admirably adapted to the production of first-class timber and the system of High Forest should be adopted in lieu of the prevailing one of Coppice with Standards, which is derimental to the production of first-class timber. Formerly underwood realised up to £40 an acre for twelve to fourteen years' growth, and as it yielded a regular annual income it was more valuable than timber. The price has now depreciated to about 50s. per acre and it is only worth growing in districts where a demand for special purposes causes it to maintain a value of £6 to £10 per acre. Eighty-nine per cent. of the timber imported into this country is coniferous, and as conifers do not require such good soils as the broad-leaved trees, the former are especially adapted for planting on waste land, the most suitable being larch, Pacific Douglas fir, Scotch pine, and Spruce. Ash and oak are the most valuable hardwoods and in the greatest demand, as the quality of imported Oak and Ash is distinctly inferior to that grown in Great Britain. Sycamore, Sweet Chestnut, Beech, and Willow can be advantageously grown in certain localities. Different species attain most profitable maturity at different ages, which vary with soil and locality, but the following may be taken as the average. Sweet Chestnut, 55 years; Larch and Ash, 70 to 75; Scotch Pine and Sycamore, 80; Spruce, 80 to 90; Oak, 120; and Beech, 130. Oak and Beech usually yield little or no income from thinnings until they are 60 years old. They also take a considerable period to mature, and for these reasons are more suitable for State planting than for the use of private owners, as the latter usually require as speedy a monetary return as possible, whereas the State can afford to wait.

ESTATE FORESTRY.

There are also a large number of estates with land possessing little or no agricultural value which would yield far higher returns if they were planted and also considerably enhance the capital value of the properties to which they are attached. A speedy monetary return is frequently required and to meet this requirement Ash and Larch will prove most suitable, as they mature early, and the thinnings are saleable from the earliest stages. Douglas Fir, Willow, Sycamore, and Chestnut are also well adapted for this purpose. The majority of landowners preserve a large head of game, and where this is done the system of Coppice with Standards must displace High Forest to a certain extent. The quality of the timber will suffer somewhat from this, but by following the system adopted extensively in France of cutting the underwood every twenty-five years, it will be considerably more valuable than that produced by our woods at present, where the underwood is usually cut every twelve years.

The success of all plantations is largely dependent upon:

(*a*) Selecting the species most suitable for the soil and situation on which the trees are to grow, irrespective of their financial value.

(*b*) By paying attention to *every detail* of management from the time a plantation is formed until the mature crop is sold.

(*c*) By stringently keeping down rabbits.

(*d*) By introducing catch crops to maintain soil fertility and to produce a maximum profit.

(*e*) By exercising the strictest economy in the initial outlay, as the money spent accumulates at compound interest throughout the rotation.

It is also essential to obtain as far as possible a steady annual income from woods instead of large sums at intermittent periods.

FORESTRY EDUCATION.

The neglect which this side of the subject has received in Great Britain is largely responsible for the prevailing belief that forestry cannot be made to pay. Two hundred and twenty-five years ago continental woods yielded little or no higher returns than our own do now. During the intervening period foreign countries have adopted a systematic study of the subject, and, in consequence, foreign woodlands yield far higher returns than British ones do at present. It is impossible to improve existing woodlands or to persuade the State, Municipal Bodies, or landowners to undertake afforestation until they are convinced of this, and it is essential to educate, not only them, but also land agents and foresters on this point. Formerly a system of wide planting and extensive thinning was generally adopted, causing the production of short, branching trees and a small crop, and there is still a great tendency to maintain the old system, as the benefits of thick planting and gradual thinning have not yet been thoroughly realised. By doing this crops of far higher quality and greater bulk are produced. Timber is also frequently cut before it is mature, or allowed to stand too long, when it depreciates, which causes further loss, as the woods should have been cut and replanted. Underwood, which is no longer profitable, is still grown instead of converting as much as is not required for cover into Highwood. Trees have also frequently been planted in soils and situations absolutely unsuited for them, and, in consequence, they do not thrive, or become sickly or diseased, and financial loss results. The Larch is a striking example of this: when this tree was first introduced and it was ascertained that the timber was of high quality and realised a good price, it was planted indiscriminately, and this is one of the chief reasons for the devastation caused in numbers of plantations by Larch disease; species of lower financial value suitable for the soil and situation would have thrived and produced higher returns. A State school should be started for all men in the Government service, both officials and woodmen, and only trained men should be employed. It is also essential that all land agents should receive a thorough and practical training in the subject, as it is only of secondary importance to agriculture in estate management.

WHAT THE GOVERNMENT MIGHT DO.

In rural districts this subject should only occupy a place of secondary importance to that of agriculture, and a Government Department should be formed to deal *exclusively* with forestry, its main duties being:

1. To undertake and supervise the management of all Crown woods.
2. To arrange loans for planting on settled estates.
3. To educate those interested in the subject by the distribution of leaflets dealing with forestry from time to time similar to those issued by the Board of Agriculture for the benefit of persons interested in farming.

The two latter duties are now performed by the Board of Agriculture. All officials of the Board should be picked men possessing an intimate knowledge of the practical and financial side of the subject, as it is absurd to expect success unless the matter is dealt with on business principles. Two Commissions were appointed in 1887 and 1902 to advise and report on British Forestry. Their recommendations have been carried out to a limited extent, but much more remains to be done, and the Government might appoint an Investigation Committee with advantage, composed of members capable of dealing with the subject, to visit and report on the management and financial returns obtained from State woods in Germany, France, and Scandinavia, and the advisability of afforesting suitable areas of waste land in Great Britain, if they do not feel justified in acting on the report of the two committees, and it is certain much valuable information would be obtained by such an inquiry. The present Government has pledged itself to look after rural interests as far as possible, and by dealing with this subject they would be doing so by tending to decrease the rural exodus by keeping the people on the land, and also confer a benefit on the nation by dealing with a matter which is of great importance, not only from the individual but from the national standpoint, and one which should have been dealt with many years ago.

Note.—**The Third and Fourth Prize Essays will be published in a later issue of *The Speaker*.**

MENDEL'S LAWS IN THEIR BEARING ON AGRICULTURE.

By T. B. WOOD.

THE rediscovery of Mendel's Laws some eight years ago put into the hands of the plant breeder a method which cannot fail to lead to results of the greatest economic importance. Mendel's discoveries are of the highest scientific interest, but it is to their economic applications that the attention of agriculturists is chiefly turned, and perhaps the best way to explain these is to give a short account of some of the results which have been already obtained.

In breeding it is always half the battle to know exactly the ideal to which it is desirable to attain, and this has been stated very definitely in the case of wheat by the Home-Grown Wheat Committee of the Millers' Association. Their statement is somewhat as follows: Certain foreign wheats—for instance, some of those grown in Canada—possess a quality known as strength, in virtue of which they make a large, white, spongy loaf. Certain other wheats, notably those grown at the present time in England, lack this quality of strength, and are described as weak because they make a loaf which is comparatively small, dark-coloured, and damp. Now, the present-day public taste demands a large, white, spongy loaf, such as is made from the flour of strong foreign wheats. The result is that these wheats make in our own markets from two to five shillings per quarter more than our own home-grown wheats.

Seed of some of these strong wheats has been imported and grown in England, and certain varieties are found to retain their strength in the English climate. They are not, however, suitable in other respects for the English farmer, as they lack the vigour of growth and cropping power of our own varieties.

Here we have, then, a definite problem, to transfer the valuable quality of strength of grain possessed by these foreign wheats to our own vigorous high cropping varieties, and so produce new varieties which will yield a full crop of wheat, worth as much per quarter as, say, Manitoba Hard. Ten years ago the odds against anyone bringing this result to pass in a reasonable time would have been enormous, but in the light of Mendel's Laws, Mr. R. H. Biffen, of the Cambridge University Department of Agriculture, has succeeded in doing so in the short space of six years.

Mendel, working with garden peas, showed that when two varieties, differing in a number of characters, are crossed together, and the hybrid seed sown, a perfectly uniform first generation is obtained, which may inherit certain characters from each parent. If seed is saved from this crop, and a second generation grown, uniformity is no longer obtained, but the crop consists of a number of different types. Among these no new characters appear, but the characters of the original parents are re-arranged in every possible combination.

To apply these ideas to the solution of our wheat problem, let us imagine that the vigour of growth and weakness of grain of our English varieties, and the feebleness of growth and strength of grain of certain foreign sorts are two pairs of characters in the Mendelian sense. Then by crossing these two varieties we should obtain in the second generation after the cross four types—vigorous growth combined with weak grain, vigorous growth combined with strong grain, feeble growth combined with weak grain, and feeble growth combined with strong grain. Of these the second type, in which English vigour of growth is combined with strong grain, is the one we want, and the rest may be thrown away.

If, now, this type can be fixed the problem is solved, and here again Mendel's work points out clearly the method of procedure.

Seed must be saved separately from a large number of individual plants of the desired type, picked out of the second generation, and this seed must be sown in rows in such a manner that each row contains the seed saved from one single plant. When harvest time comes it is found that some rows are perfectly true to type, and contain nothing but vigorous plants with strong grain, while other rows contain plants of all four types. These latter are destroyed, and seed saved only from the rows which have bred true. This seed is sown again and found to continue to breed true year after year.

Working on these lines Mr. Biffen has found that strength and weakness of grain form a pair of Mendelian characters. After crossing several of the strongest foreign wheats with several of the most vigorous of our own English varieties, and growing a second generation, he has been able to pick out a number of types in which foreign strength of grain is combined with English vigour of growth. These types have been fixed as indicated above, and there are now on the University Farm about twenty new varieties of wheat, which combine the cropping power of the best English varieties with the strength of the best foreign sorts.

Their fixity is shown by the fact that although grown last year in large field plots containing many thousands of plants, not a single plant could be found which differed from the desired type. Six of the new varieties produced enough seed to be milled and baked, and their flour was found to make a loaf as large, white, and spongy as the best foreign flour. Their strength is therefore quite satisfactory, and it only remains to grow them on until sufficient seed is obtained for distribution throughout the country.

The economic importance of the establishment of such varieties will be realised when it is pointed out that their increased value over ordinary English wheat may be confidently expected to be at least two shillings per quarter, which with an average crop means about ten shillings per acre, or more than half an average rent.

During the course of the above described work another point of extraordinary interest has been discovered. Among the hundreds of varieties of wheat grown on the University Farm as possible parents, two have been noticed year after year to be absolutely free from the attacks of diseases such as rust, while several others have succumbed to these diseases to such an extent that seed has been saved from them with considerable difficulty.

Crosses were made between these immune and susceptible varieties, on the chance that immunity and susceptibility might turn out to be a pair of Mendelian characters. This has been found to be the case, and there is therefore no difficulty in transferring immunity to disease from one of these naturally immune varieties to any wheat which possesses characters which are otherwise valuable.

This work on wheat has been rather fully described, since it is at present further advanced than that on any other crop. However, work on similar lines is already well on the way with barley, mangels, peas, and a number of other crops, the idea being to rearrange the characters of the known varieties so as to combine all the good characters in one race. Judging by the success which has attended the application of Mendelian ideas to wheat breeding, great improvements in these other crops may be confidently expected.

Such work is of national importance, and it would appear that the Government could in no way confer a greater benefit on English agriculture than by encouraging it in every possible manner. A few hundred or even thousand pounds of Government money given to defray the expenses of workers who have shown themselves capable of carrying out research of this kind could not be more profitably invested.

This is even more urgently needed in the case of animal breeding, for animals obey Mendel's Laws just as plants do.

Already a large amount of pioneer work has been done. Thus the inheritance of such obvious characters as the colour of the plumage and shape of the comb of many breeds of fowls, the coat colours of horses, rabbits, rats, and mice, and face colour and horns in sheep, has been investigated, and in each case found to follow Mendelian lines. This being so, it is in the highest degree probable that breeding experiments on these lines, conducted with a view to study the inheritance of characters of economic importance—such, for instance, as early maturity in sheep, cattle, and pigs, milk production in cattle, and immunity to disease—would lead to great improvements in our national breeds of farm animals Unfortunately such experiments would require more capital than any agricultural institution could possibly provide, and they must therefore wait until the Government is sufficiently far-seeing to provide funds for a line of research which promises such great benefits to English agriculture.

AGRICULTURAL CO-OPERATION.

By Edward Owen Greening.

IT is just forty years ago this year since I induced my friend Thomas Hughes to join me in an effort to carry co-operation into the region of rural Britain. Those who, like myself, had the happiness to know Thomas Hughes intimately will remember how curiously he attracted the deeply affectionate regard of men of all political parties and all religious beliefs. An advanced Radical himself of the philosophical school, he had warm friends amongst Tories, Whigs, and Moderate Liberals, and in spite of his very Broad Churchmanship he was held in the highest esteem by High and Low Church and every section of Dissent. Just as Tom Brown, the schoolboy hero he created, has become the idol of all old schoolboys everywhere, Thomas Hughes himself was the cherished friend of almost all who sought the betterment of men in the highest sense of the word "betterment." This catholicity of the influence of Thomas Hughes gave us an immense advantage in the new movement we were projecting. It gave me an opportunity of arguing the need for agricultural co-operation not only with men like John Stuart Mill, John Ruskin, Professor Fawcett, Charles Kingsley, Edward Vansittart Neale, and John Malcolm Ludlow, who were predisposed by conviction and sentiment to a possible large development of the working sphere of co-operation; but it also opened the door of consideration of such differing politicians as the late Lords Salisbury, Palmerston, and Derby, the present Duke of Devonshire, and the then Duke of Bedford, Professor Goldwin Smith, and others.

If the farmers of England had been open to entertain a new movement like agricultural co-operation, conceived purely in their highest interest, there was intellectual and social influence enough at the beginning to sweep them all into the co-operative fold forthwith. That so little has come of it in forty years, compared with the giant growth made by industrial co-operation in the same period, seems a wonderful demonstration of the influence of social conservatism. It recalls to me the striking words which ended a long discussion I had with the late Lord Salisbury. I had shown him the dire need for the movement, and argued that where the necessity was so grave and urgent there must be hope of a ready response from the class to be benefited. "Mr. Greening," he replied, "it is all true, too true; but—you have not fathomed the density of the stupidity of the agricultural mind!"

Up to 1846-48 British agriculture was subsidised by protectionist arrangements. When the Corn Laws were repealed, agriculture had another thirty years of exceptional good luck. The wonderful burst of prosperity in the towns which followed on Free Trade gave farmers new markets of great value. These new markets were in the hands of British cultivators to supply for over a quarter of a century. During that time sea freights and land carriage were being cheapened by science. When 1878-1879 brought phenomenally bad harvest seasons here the produce of America and other distant lands was found to be easily and cheaply accessible to our town populations. Low prices and full supplies have ruled ever since. In 1866, when I pioneered the first step in agricultural co-operation, farmers were still having a good time on easy terms. They regarded proposals of co-operation as being well enough for working people but unworthy their own notice. They had perhaps a general suspicion that the abounding army of prosperous local middlemen did well out of them. But their one idea was to remedy that state of things by grumbling and bargaining. Our advocacy of co-operation fell on deaf ears. But we made a beginning.

The first society was the Agricultural and Horticultural Association, now best known by its briefer motto-title of "One-and-All." This motto-title was suggested by Mr. Walter Morrison, then Radical member for Plymouth. The association, of course, still exists and I am still its managing director. A second society was soon established at Aspatria, in Cumberland, on the estates of the late Sir Wilfrid Lawson and his brother William Lawson, both ardent friends of co-operation. Others followed at Alnwick, on the Duke of Northumberland's estate, in Cheshire, in Lancashire, a second in Cumberland, one in Warwickshire, one at Plymouth, in Devon, and one in Scotland. In all, about fifteen societies constituted the pioneer movement. At least a dozen of these are still usefully at work doing a business of about three-quarters of a million sterling and making profits of about twenty-five thousand pounds annually. They have probably saved their members some millions of money in the past thirty or forty years. They have certainly kept the lamp burning to show the way to more recent workers abroad and at home.

The second movement in agricultural co-operation took quite a novel departure. It was pioneered about 1868 by the late William Little, well known in London journalistic circles as brother-in-law and partner of Mr. Ingram, the founder of the *Illustrated London News*. Mr. Little was on the council of our "One-and-All" Association in its early days, and a personal friend of my own. He came to the conclusion that agricultural co-operation in its complete form was not sufficiently simple to meet the ideas of farmers. He, therefore, founded the Lincolnshire Farmers' Association at Sleaford amongst his friends and neighbours. This form of co-operation consists of a voluntary association without capital, warehouses, works, or stocks of goods. The members pay a trifling sum per acre as an entrance fee. This gives the society its start. One or two articles only are dealt in. These are contracted for with manufacturers who work under inspection of a committee of the society and supply direct to the members at wholesale prices after the stocks have been analysed and passed as satisfactory. The Lincolnshire Farmers' Association still exists in its original form, and has grown big enough to set the annual market price of superphosphate of lime, of which it is the largest buyer in the kingdom. Each member is supplied at cost price but pays one shilling per ton commission to the society. These odd shillings have created a reserve fund of over a thousand pounds.

The societies pioneered by Mr. Little came to be called "clubs." Some fifteen or twenty of them were established, chiefly in the West of England. Many are still flourishing, but they have not developed much beyond their original meagre programmes of work. The movement had to travel by way of Denmark, Sweden, Holland, and back through Ireland to our own country before it took a new departure. Its success in Denmark was due to the prevalence of higher educa-

tion amongst all classes. When Denmark lay prostrate after the war with Austria and Prussia the good Bishop Grundtvig conceived the idea of making university training in Denmark as common as in Scotland. His belief was that Denmark could only rise again through the superiority of the Danes themselves. He succeeded beyond his most ardent expectations. The cheap colleges of Denmark have rendered her peasants the most skilled and scientific farmers in Europe. They have rendered the whole population apt for mutual co-operation. They have made the prosperity of the little kingdom the talk of civilisation.

We all know how agricultural co-operation was pioneered in Ireland by the self-denying and heroic work of the Right Honourable Sir Horace Plunkett, who saw the wonderful work done in Denmark and set out to reproduce the results in his own beloved country with the help at first of British co-operators. About six or seven years ago, when Sir Horace Plunkett had surmounted his early difficulties in Ireland, Mr. W. L. Charleton, of Newark, who had been over to see and to help, determined to attempt to found a central organisation society in England on the Irish models. I had the privilege to be the first adherent to join in 1900, although my experience had given me little hope of seeing the new movement spread widely amongst English farmers.

Under the hands first of the late Lord Winchilsea, and since of Mr. R. A. Yerburgh, the Hon. T. A. Brassey, Sir F. A. Channing, M.P., and others, the Agricultural Organisation Society has made much progress. It has founded about 120 societies, with a membership of nearly 8,000 agriculturists and a combined turnover of nearly a quarter of a million sterling. Many of these societies being still young, the profits are small and development is still uphill work. The most hopeful feature is the variety of work undertaken. Some are dairy societies for the sale of milk or production of butter. Some are rural credit banks. Some establish allotments and help the allotment holders in many ways. Some are supply societies for the purchase of seeds, fertilisers, farm implements, and feeding stuffs for cattle. Some collect and market eggs and poultry. The variety of endeavour shows that the needs of the local cultivators are the inspiring force in the institution of societies. The cost in labour and money entailed upon the devoted workers of the organisation is very great and is a new proof, if one were needed, of the inertia which has to be overcome in order to effectually benefit English rural life.

If I am asked, "What remains to be done?" I must truthfully reply that only the very fringe of the task has yet been touched. The head of an English firm of wholesale seed merchants has just concluded a journey through Holland, Denmark, Sweden, and Norway. He returns with the feeling that our farmers are simply hopelessly distanced in the march of agricultural progress. "Everywhere at home," he says, "a buyer still asks as first question regarding seeds, 'What is the price?' Then he tries to judge by rule-of-thumb inspection of a sample! Everywhere in the countries where agricultural co-operation prevails the first question is, 'What is the weight per 1,000 seeds?' Next, 'What is the tested purity?' Then, 'What is the proved vitality or germination?' Last of all, 'What is the price?'"

The educated, intelligent Dane knows the first thing necessary is to call in science to his aid in supplying his farm with all requisites. He takes the same course in disposing of his produce. He sells his eggs by weight and his milk by its constituents of fat, &c. He both buys and sells, produces and distributes, co-operatively.

I fear there is much to be done here in rural education, in technical education, in higher education, as well as in the development of rural co-operation, before we can rest on our oars.

PROSPECTS OF AGRICULTURE.

AS that uncertain element, the weather, is the dominating factor in agricultural prospects at all times, it is rather difficult to make a useful forecast for any particular year. The British farmer is influenced by the seasons not only as they may be experienced in the United Kingdom, but he is also materially affected in his returns by what may take place throughout the world. A drought in America, India, or Australia, or an untimely deluge of rain in these regions might ruin the corn harvests there or cause a widespread loss of cattle or sheep, which would immediately raise prices here to such an extent as to put thousands of pounds in our farmers' pockets, though as the whole universe contributes to the British supply there is now less probability of isolated disaster producing serious effects. Yet, the drought a few years ago in Australia was partly responsible for an increase in the price of wool and mutton, which has not been lost even now. A bad harvest in North or South America, India or Russia, might substantially enhance the value of wheat in English fields or stackyards.

The weather, in short, makes or mars the year's farming in England as elsewhere. In the spring of 1906 farm prospects at one time looked adverse, but the summer turned out so well that the Board of Agriculture was able to estimate nearly all the crops to have been over the average in productiveness, but then the United States and Canada had also bumper wheat harvests, and prices for that article have consequently fallen, causing a heavy diminution in the value of the good crop at home. The one great exception last year as regards satisfactory produce was the hop crop, which, owing to an unprecedented attack of blight, turned out miserably, and had it not been for scientific treatment of the plants by continuous washing there would have been little or no hops in Kent or the other counties in which this very precarious crop continues to be grown. Here again is a striking example of the paramount influence of the season.

Assuming, however, that the climatic conditions this year should prove to be normal and that the promised seed-time and harvest be generally favourable, it may not be unprofitable to attempt to glance into the future, calling to one's aid the lessons learned from the past.

First of all, then, there can be no doubt that very much has been done to adapt British agriculture to the enormous changes that have been brought about by the opening up and development of the resources of new countries, by the application of steam, and by the discoveries of the agricultural mechanician. These causes combined have revolutionised farming, especially in this country, whose markets are open to the products of the world. With vast areas full of latent fertility, free of rent, having light taxes and with plenty of cheap labour (in at least some of the countries) these immense new regions were, and are, able to produce the more easily grown crops at a price which has defied successful competition under the old conditions at home. The result was at first most serious. Farmers could not, at the reduced prices received for what they had to sell, pay the former rents, and they could not carry on the ancient methods. Some landlords were unable to read the signs of the times, and even if they had possessed this prescience, they were not all in a position to concede the necessary abatements of rent. Tenants struggling on were in a number of cases ruined; the land in many instances was thrown back on the owner's hands and some of them attempted to farm the vacated holdings themselves. In other

cases—doubtless the majority—landlords perceived the impending changes, and were able to meet their tenants by adequate reductions of rent and so save them from collapse.

The net results were a substantial reduction of rent and a change of system by the extensive curtailment of wheat growing, with the laying down or "tumbling down" of large tracts to permanent pasture. Milk selling, in which the British farmer enjoys a monopoly, was largely resorted to, and continues to be the most profitable branch of the industry. To reinforce the best of the old farmers, who alone survived, a new class of tenants arose—men with ideas, skill and capital, and landlords who were wise let their farms to these occupiers on reasonable terms as to rent and freedom of management. Still, antiquated covenants existed on some estates, but these were modified in the spirit of the Agricultural Holdings Act, which will be further completed by the Act passed during the recent session of Parliament. The latter measure confers on tenants the liberty as regards cropping and sale of produce which had already been granted voluntarily on many of the best managed estates.

These changes were brought about amid much tribulation, and under them capable farmers with sufficient capital can just make a living, though where a speciality has been successfully taken up a very respectable profit may still be realised from the occupation of good land on fair and liberal terms.

A rough estimate of the value of the produce of the agricultural land of the United Kingdom, made some years ago, showed a total of 190 millions annually. Farm crops sold were reckoned to bring in about 63 million pounds, of which hay realised 17 millions, potatoes 13 millions, wheat 9 millions, barley 8 millions, oats 4 millions, and hops 2 millions. Meat was estimated to realise 74 millions, of which beef and veal were credited with 34 millions, mutton and lamb 23 millions, bacon and pork 14 millions, poultry and rabbits 2 millions. Dairy produce was estimated to bring in 49 millions, milk standing at 15 millions, butter 11 millions, cheese 5 millions, wool 4 millions, and eggs 8 millions. It will thus be seen that live stock and their products far exceed in value the returns from the farm crops sold. Consequently, under the modern system of farming live stock occupies the first place, and therefore the importance of safeguarding it from the risk of disease is apparent. As has been said, milk selling has proved a remunerative branch, though so many have now adopted it that the profits are considerably reduced. Last year prices advanced owing to the drought, but, with contracts to fill, farmers as a rule did not obtain much of the increase. With higher prices prevailing there has also been an extension of cheese-making. Mutton and wool have sold very well and are likely to continue to do so. Mutton bred and fed in the United Kingdom enjoys a distinct preference in the markets, and the imported article cannot displace it. It has been different with beef, which was an unprofitable business until near the end of the year, when trade brightened up to some extent for choice quality. There is a strong feeling that British beef competes under a disadvantage in the markets, owing to the facility with which the imported article can be substituted, and that steps should be taken to ensure that home-bred and home-fed beef should be supplied when it is required. But, apart from that, the world's supply of beef seems for the time to have exceeded the demand. The vast increase in the Argentine shipments has had a considerable effect in this direction. In various continental countries, notably Germany and Austria, there is a powerful agitation among the working classes to secure a share of the cheaper and superior beef produced abroad. This demand will not be silenced, and it is in the removal of restrictions on imports to these countries that British farmers may look for relief from the present pressure of imported meat, which comes here alone, whereas at any rate a part of it is more needed elsewhere. When the poorly-fed people of these continental countries can secure a portion of the wholesome imported beef that is at present so plentiful in our markets, the depression in the business of producing it in the United Kingdom will be modified.

The best policy for the British farmer is evidently to have his products as diversified and high-class as possible. He should endeavour to make a little out of his corn, hay, and potato crops, his cattle, sheep, and pigs, and his poultry, &c. To have a speciality in any of these articles is a very decided advantage. Of course, it is not every farm or every district that is capable of producing all, but, as far as possible, the error of having all the eggs in one basket should be avoided.

Many farmers now cater for the demand for pedigree stock, not only at home but from abroad, and it is among those who pursue this branch of the industry with judgment and ability that the most prosperous tenants are to be found.

Farmers desire certain practical remedies to enable them to hold their own in face of unlimited competition. They wish to see a readjustment of local taxation, which has hitherto been placed too heavily upon the land and its products; they desire that adulteration and substitution should be prevented; and they hope to find the railway companies more sympathetic in aiding agriculture by granting reduced rates.

It is a good sign that more advantage is now taken of the discoveries of science in regard to artificial manures; in combating the various insect and fungoid pests that inflict so much damage on crops; and in availing of veterinary advice in preserving the health of their stock. Co-operation is making slow but steady progress, and many look to the wide extension of this principle as likely to do much to solve some of the present difficulties and improve the prospects of British agriculture not only in 1907 but for all future time.

THE POTATO.

By Martin H. F. Sutton.

FROM the time when Columbus first sighted America in his attempt to reach India by sailing westward, and the peoples of Europe awoke to the fact that the planet on which they lived was of greater dimensions than they had previously supposed, many advantages consequent upon that discovery have resulted to both continents. Champions of the old world and the new might argue almost *ad infinitum* as to which has been the greater gainer by the knowledge of the other's existence. If the civilisation of the East has proved a blessing to the previously unenlightened West, the West in its turn has provided an invaluable field for migration to the rapidly increasing populations of the nations of Europe.

On whatever side the balance of honours may lie, it is certain that in supplying the old world with the potato the American continent has conferred a blessing on Europe, and through Europe on mankind generally, the value of which it is impossible to calculate.

The potato appears to have first reached Europe at the beginning of the sixteenth century *viâ* Spain, and to have been brought from the mountainous slopes of Ecuador. Thence it was introduced into other European countries, notably Italy and Austria. Who first brought the potato to this country is still a debatable point. The honour of introducing it has equally been claimed for Sir John Hawkins, Sir Francis Drake, and Sir Walter Raleigh. Whatever evidence there may be in favour of Sir John Hawkins and Sir Francis Drake, it is certain that Sir Walter Raleigh either brought it

back with him in the course of one of his voyages or that it was brought to him by the colonists whom he sent out to Virginia in 1584 and who returned a year or two later. Sir Walter Raleigh planted it on his estate in Cork, but its worth does not appear to have been appreciated or understood until some years afterwards.

Probably no country in the world has been so long dependent on the potato as an article of food as has Ireland, and it is an interesting fact that it was in Ireland that its cultivation was first seriously undertaken. Thence it was introduced about the end of the seventeenth century into the midland counties of England. From that time onward it greatly rose in favour until it attained its present position of incomparably the most important vegetable that we possess.

Any member of the animal or vegetable kingdom that proves serviceable to man receives in due time the attention of the specialist. The potato is no exception to this rule, and if the plants grown in the early years of its culture in these islands could be compared with the best varieties of to-day a vast improvement would undoubtedly be noticeable. Indeed, it is open to question whether the long delay which occurred between the time of its introduction into this country and its regular cultivation may not be due to its semi-wild condition and habit of growth when it reached these shores and whether undue blame has not consequently been meted out to our forefathers for their alleged want of enterprise in failing to at once adopt it as a food commodity.

To the general reader it may not be known that the potato of commerce is but one member of a very considerable family; so considerable, indeed, that Bentham and Hooker estimated that there are somewhere about 700 distinct species of solanums, and these comprise plants so widely different as the potato on one side and the ornamental berried plant of our greenhouses, *Solanum capsicastrum*, on the other. Only a very small proportion, however, of this number produce tubers.

During the last hundred years several attempts have been made to identify the wild form which gave rise to this valuable vegetable, but though much useful work has been done it is still doubtful whether either of the wild types now cultivated in the experimental grounds of England, or indeed of Europe, can be certified as the typical form of *Solanum tuberosum*.

One of the first authenticated occasions known to the writer when a *wild* form of this plant was sent to Europe in the belief that it was the original type of the potato of commerce was in 1822, when Mr. Alexander Caldcleugh, secretary to the British Minister at Rio de Janeiro, brought two tubers to this country and stated that the leaves and flowers of the plant were similar in every respect to those of the potato cultivated in England and elsewhere. Possibly Mr. Caldcleugh arrived at his conclusions through ignorance of the fact that many forms of the wild potato existed. Be this as it may, further investigation clearly demonstrated that his views were incorrect, and from that time to the present a more or less continuous search has been made in different parts of South America (in which part of the American continent it is now generally agreed that the potato had its origin), and various most interesting wild forms, differing totally the one from the other, have been discovered.

This is not a scientific article, and a further description of the wild types at present known would consequently be out of place; but perhaps enough has been said to indicate the very interesting character of research work in this connection.

To the man in the street a potato is a potato, just as grass is grass; and doubtless he would be much astonished were he informed that many hundreds of varieties exist, each possessing its own idiosyncrasies and eccentricities almost to as great a degree as man himself. Yet this is a fact of which the specialist is fully aware and which he has to take into careful account in his work of cross-fertilisation.

Some varieties are early, others are late; some have hard flesh, others soft; some prefer one soil, some another; some have white skins, others coloured; while some possess a white flesh, some a yellow, and one, at least, a black. Nor is even this Nature's limit, for within the last two years a further step has been obtained in a potato possessing a flesh as distinctly pink throughout as that above mentioned is black.

Such variations are, however, of little value apart from their scientific interest, as they are never likely to increase the popularity of the potato. Fashion dictates that in this country a potato to find favour must possess a white flesh, a quality which would seem to appeal very specially to the Anglo-Saxon race, inasmuch as a white-fleshed potato is a *sine quâ non* also in the United States, while yellow-fleshed potatoes are almost universal throughout the continent of Europe.

It is an unwritten law that the producer must adapt his commodities to the public taste if he is to succeed, and doubtless it is due to this fact that seldom does a new variety now find its way on to the market possessing flesh of the colour so popular across the Channel. Taste in most things is so fickle that the determination with which we cling to our white-fleshed potato is remarkable, the more so as it cannot be denied that a yellow-fleshed variety has the better flavour. The British race is, however, notoriously conservative in such matters, and the advocates of a change in this respect will probably have to wait in vain unless varieties of this valuable vegetable owning these characteristics are found to contain remarkable properties for the cure of influenza or other ills of mankind!

Attention has already been drawn to the peculiarities possessed by different varieties, and to the fact that in this aspect they bear some resemblance to man. Unfortunately, that resemblance is true from another point of view also, for the potato is subject to many ailments, and the number tends to increase as time goes on rather than to diminish. How far man's efforts to improve the plant may be responsible for this it is impossible to say, but the practical botanist knows only too well that improvement of type and liability to disease go hand in hand. The potato raiser of the future will have to give as much attention to hardiness of stock as to weight per acre, and it is in the amalgamation of these two qualities combined with flavour that the greatest success will be achieved.

COMMERCIAL POULTRY.

By EDWARD BROWN, F.L.S.

IN spite of all that has been done in the past there yet remains a considerable amount of prejudice against poultry-keeping in some parts of the country; but those who have been engaged in promoting this industry have the satisfaction of knowing that very marked advance has been made, and the prejudices referred to are by no means so vigorous as was at one time the case. During the last fifteen years the production of eggs and chickens in Great Britain has increased enormously—not, however, equal to the demand, as indicated by the growing supplies from abroad. This increase is seen both in egg production and table poultry, and it is not too much to say that the production is in value more than two million pounds greater annually than was the case a few years ago.

To a large extent poultry-keeping is a branch of general agriculture, and the wider our observations the more evident it is that we must always depend chiefly upon farmers and those living in rural districts for our

supplies. Under these circumstances production is cheaper and expenses distinctly less. Moreover, poultry-keeping as a branch of farming conduces to the greater prosperity of agriculture generally. At the present time there are probably not more than about 750 fowls per thousand acres of cultivated land upon the farms of the country, which number could be increased four-fold without interference with any other branch of the operations, whilst the manurial benefit would be very considerable indeed. With the present movement which is going on for the extension of small holdings in this country we may anticipate that there will be a great increase in poultry-keeping. Fowls can be managed by various members of the household; they have the advantage of bringing in money regularly, as the produce is fairly constant; and it is seen in every part of the world that with the growth of smaller occupations the number of poultry kept is correspondingly increased. In the large farm districts the percentage of fowls per acre is generally much lower than where the holdings are smaller. At the same time we have abundant proof that this branch of live stock can be made profitable upon larger farms if they are well managed. It is this management, however, which is the difficulty, as the number of trained operators is by no means equal to the requirements.

At the same time, however, it is well to recognise that there is a distinct place in connection with the poultry industry for special establishments carried out upon a more intensive and extensive scale. These establishments are found in our own country, but as a rule we have given a greater amount of attention to the production of stock birds and eggs for hatching than for the ordinary market supplies. During my visit to America in the summer of last year I inspected a number of the big plants which are established in that country. I was at places where they have as many as 4,000 to 5,000 laying hens, the work being splendidly systematised and carried out in the best manner possible. It is evident that where the operations are large enough this side can be made profitable, but the capital required is considerable, and also the management must be of the very best—in fact, it partakes more of the commercial and manufacturing side than is true in connection with farming. In all these establishments, however, with one solitary exception, a great deal of attention is given to the production of stock birds, to the sale of eggs for hatching, of day-old chickens, or of broilers, and I firmly believe that such establishments in this country must follow upon the same lines. Under those circumstances they will render a very great service, as work can be carried out for the improvement of poultry which would be impossible to the ordinary farmer. There is one point which is often forgotten in connection with this subject, namely, that the individual profit of each fowl is comparatively small, and therefore to yield large returns it is necessary to have a considerable number. We find that a gross profit per annum can be made of 4s. to 5s. per hen, and therefore to yield a gross profit of £100 per annum there must be at least 400 to 500 birds. I mention these facts because many of those who go in for poultry-keeping fail to realise the importance of extending their operations to the extent necessary to yield them satisfactory returns.

Whilst, therefore, it may be accepted that the basis of our supplies will be from the farmers of the country, and consequently both farmers and cottagers should be encouraged to keep poultry to the fullest extent possible, yet there is a great and an ever increasing need for special establishments conducted upon systematic lines, and the fullest encouragement should be given to such plants. At the same time we require that our knowledge upon this subject shall be greatly enlarged, and one of the directions in which America is distinctly in advance of our own country is the attention given to experimental work. We have only touched the fringe of that question, and until sufficient support is given to our colleges and public institutions for research it is impossible for this branch to receive the amount of attention urgently required. Something has been done in the direction of improvement all round, and especially in connection with the marketing of produce. The Utility Poultry Club and the National Poultry Organisation Society in their respective spheres have rendered a large amount of service, and the basis has been laid for development which cannot fail to yield great results to the country at large.

MAKING TOWNS MORE BEAUTIFUL.

MORE AMATEUR GARDENERS WANTED.

By HORACE J. WRIGHT.

THERE cannot be the slightest doubt that the cities and towns of the British Isles have become more beautiful during the past two decades, for in that period the number of amateur gardeners has increased immensely. This is most fortunate. It is not, of course, possible to make our great manufacturing centres places of beauty, but they can indubitably be made infinitely more attractive by the culture of flowers, and in many instances of fruits and vegetables also. And this is well. It teaches the busy worker that there is something beyond the ordinary routine of life for which he may work, and he may rest assured that when he adorns the window-sills of his home he is not only giving pleasure to himself but also to the thousands of others who pass along the street during the day, the week, or the month, as the case may be. Their circumstances may be such that it is impossible to have even one pot of flowers, and their eyes are gladdened by the brightness that has been placed before them by more fortunate fellow-men.

It is good to know that the culture of flowers has been encouraged in some districts of the Metropolis, and in several of our busy Northern towns, by the distribution to children of a plant of some kind—it may be a dry hyacinth bulb or a geranium or a fuchsia—a suitable flower-pot, and sufficient soil to carry out the necessary potting. This is a splendid movement, which will have an important effect upon the attractiveness of our cities and towns in the next generation, for it is engendering a love of plants and flowers in receptive minds where love will endure and manifest itself later in life, when the child has become a man or a woman, and has window-silis or a garden of his or her own. It would be a matter for the most intense satisfaction if the system could be extended to all the congested towns, cities, and districts of the Kingdom.

When one remembers the unfavourable conditions under which the town gardener has to do his work one must confess to a feeling of astonishment at the results that are commonly achieved. No obstacle appears to be too difficult to be overcome by the enthusiast—his garden may be surrounded by such lofty buildings that it gets little or no sunlight or fresh air; the soil may be so poverty stricken that one would say that it did not contain an atom (or ought one to say a drop?) of plant-food; the owner might conceivably be so poor that he could not spend more than a few coppers throughout the year on seeds and plants. In what, then, lies the secret of his success? Simply in the fact that he loves flowers, and his fostering care will make them grow where without it they might or might not eke out a miserable existence. The late Dean Hole used to say, "Those who would have roses in their gardens must have roses in their hearts," and this could well be made applicable to town gardeners by substituting the word

"flowers" for roses in each case. The roses themselves, alas! will not grow in London town at any rate—for one season they live and in the second winter nearly every one of them will die, or the growth afterwards will be too weak to have the power to produce a flower worthy of the name.

While one is forced to acknowledge that roses and several other kinds of plants will not thrive amid the impure atmosphere of great industrial centres, there are many others that will flourish and produce superb blossoms every year. It is impossible to mention them all—they are too numerous—and it must suffice to refer to the few. Take carnations, for example. There are not many more beautiful flowers and they will thrive in the smokiest of places, though the purity of their colours will assuredly be sullied. Some of the finest blooms ever seen have been grown in London backyards. Auriculas, again, grow magnificently, but they have not naturally the showy charm of the carnation. On some leads in a builder's yard in Wandsworth there used to be a particularly fine collection grown by a youth, and it is quite certain that others besides himself used to derive pleasure and benefit from them. In the case of both of these plants the only essential to success is persistent, intelligent attention.

For the summer and also the spring display the town gardener is in almost as good case as his envied country cousin, for practically any plant that will grow out of doors at all will thrive, as is proved to the point of demonstration in our beautiful parks every year. In the autumn—say during October and November—bulbs of daffodils, hyacinths, tulips, Spanish irises, crocuses and others can be put in and, unless they are all scratched up by the cats, they will produce most delightful flowers in the early months of the year. When these have passed over it will be necessary to prepare for the summer display. All the bulbs must be lifted and spread in some convenient place to dry off gradually (they should be stored for planting in the following autumn) and the soil must be dug as deeply as possible; into the lower layer—what the gardener calls the second spit—should be worked some natural manure, preferably such as has been kept some little time to rot down. Then the top layer must be put back, and either firmed for immediate planting or left to solidify by settlement. If this work is done in May, "geraniums," lobelias, fuchsias, begonias, marguerites, and many other kinds may be put out early in June, and will give a brilliant display a little later—say, from the beginning of August to the end of September.

OLD-FASHIONED FLOWERS.

OLD-FASHIONED FLOWERS. By M. Maeterlinck. Translated by A. Teixeira de Mattos. With Coloured Plates by G. S. Elgood. London: George Allen.

HERE is a charming book, such as one does not see every day. It is made up differently from the style to which we have become accustomed, it is written differently, and it is illustrated differently; and each is good in its way, but the palm of excellence must be accorded to the four delightful coloured plates by Mr. Elgood, which do, indeed, show us Old-fashioned Flowers growing as nature plants them and as we all desire to see them.

It is apparent that the author is not only a lover of flowers, but of all nature, and he possesses the happy faculty of seeing all the beauties that are scattered so prodigally around us, and a pen so fluent that it paints the scenes with something of the magic touch of the artist's brush. Mr. Maeterlinck wonders what the world would be like had we not the flowers of the field, hedgerow, copse, woodland, and hillside. Well, as he truly asserts, it would be a dreary place and life would lose more than half of its purest charm. Human nature deprived of the exquisite influence of the flowers would certainly degenerate, and, bad as the world is now, if we may believe all that moralists would have us believe, it would be infinitely worse, and the grumblers and fault-finders have unlimited material for their most scathing denunciations.

Yes, Mr. Maeterlinck is wholly correct and most fascinating to read as long as he remains among the old-fashioned flowers that he loves with such an inspiring intensity. But when he commences to make comparisons with the flowers of the garden he essays a task that is quite unnecessary, and which, too, is beyond his horticultural or botanical knowledge. Whoever heard of Begonia Tuberosa? It is said that it "swarms in the beds like a tribe of turbulent fighting-cocks." That there are tuberous-rooted Begonias all the world knows, but all the world does not know what Begonia Tuberosa may be. Again Mr. Maeterlinck attacks the Double Geranium as a plant that has ousted the old-fashioned flowers from our gardens. Presuming that the Zonal Pelargonium is alluded to, the author is somewhat off the track, as for every double-flowered plant that is used for summer-bedding there are at least one thousand, and probably far more, that are grown for their single blossoms.

Thus it is seen that this is not a book of instruction in gardening, but one which, nevertheless, is well worth the reading, for it will call to mind beauties that may have been forgotten, and tell us, maybe, of others that it has never been our joy to see. Each of Mr. Elgood's plates is beautiful, but perhaps the most charming of all is "Foxglove and Dog-rose."

BRITISH DOGS.

BRITISH DOGS AT WORK. By A. Croxton Smith. With Illustrations by G. Vernon Stokes. London: Adam and Charles Black. 7s. 6d. net.

THERE is only one expression by which we can show our appreciation of Mr. A. Croxton Smith's *British Dogs at Work*, and it is by saying we are charmed with it from cover to cover. Here is a book which should appeal to every dog-lover, whether he be amateur, owning one faithful friend, or expert with his kennel. The text of the book is not intended to deal with the many questions of management, but its object is "to afford some help and interest to the thousands who keep one or two dogs as workers or as pets, or to the more limited number who may contemplate getting together a kennel for purposes of exhibition." How thoroughly the work is performed can only be estimated by a careful perusal of the pages. Passing rapidly over that portion which deals with the historical aspect of the relationship between man and dog, interesting and entertaining though it is, we come to the business section. We are told, and told without too much technical phraseology, how to construct our kennel, and the various materials employed in their making are discussed. One very important chapter is that relative to the choice of breed, and with the purchase of a suitable specimen when once a decision has been made. Further chapters are taken up by the telling of the story of feeding and rearing, of general management, of breeding scientifically, and the treatment of dogs in health and ailment. Moreover, the working of dogs is fully entered into, and whether the reader has interest in the direction of hounds or shooting dogs a fund of information will be found therein. One excellent feature of the book is the illustrative work by Mr. G. Vernon Stokes. The pictures are splendid and true to life, and there is only one fault we can find, and it is that in some instances the colouring of the background is rather too vivid, taking away somewhat from the striking likeness of the breeds depicted. Of the twenty illustrations in colour, the best is undoubtedly that of the bulldog, but following closely are those of the pointer, deerhound, English setter, and cocker spaniel. *British Dogs at Work* should find a prominent position on the book shelves of every dog-keeper.

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